energy) resources using a software defined control algorithms and power switching elements.

[0014] FIG. **2** depicts an aspect of this invention which uses an I.C. motor-generator, heavy or light fueled, which drives a multi-phase, variable speed, variable frequency permanent magnet alternator or an actively rectified generator. The output of the alternator is fed into a multi-phase, bridge-rectified, power transistorized switching inverter which is optimally transformer less for lighter weight and less cost.

[0015] FIG. **3** depicts a schematic detail of FIG. **2**. as a preferred embodiment of this invention which employs an internal combustion engine directly driving a permanent magnet, three-phase alternator using an electronic power inverter as a local, fossil fueled powered AC-generation element.

DETAILED DESCRIPTION

[0016] In the preferred embodiment, a power generation system comprises a conventional motor-generator system as may be found in a stand-by power system with the addition of integrated renewable and stored energy assets. A software defined control system allows for optimizing total cost of power and allows user control or interconnection with micro-grid or Utility Power systems. This system may be packaged in a single, weather-rated outdoor enclosure for the power producing and control elements keeping the fuel storage and the renewable energy systems remotely located and connected.

[0017] Thus, the present invention relates to adding and controlling additional, integrated-Renewable and stored energy sources to conventional fossil-fueled electric generators (base-load, stationary, or portable auxiliary power systems) of any size. This augmentation includes generator systems whose output is electricity alone, may also be employed to integrate renewable energy sources with combined heat and power (CHP) systems where both electric and heat loads (heating and cooling) are desired.

[0018] The present electrical generating system may be employed to generate solely electrical power or be configured to supply both electrical and thermal energy. Such systems have been conventionally called Combined Heat and Power (CHP) systems and offer the advantage of the highest efficiency of use of fossil fuel sources where there is a balanced need for generating both electrical and thermal power from fossil fuel sources. It is understood that the thermal output of such systems may be employed for district heating or through the use of absorption cooling cycles also offer district cooling.

[0019] A common use of such fossil fueled electrical or CHP systems has been in so called standby power systems which remain idle until an interruption in Utility supplied power sources are interrupted. Such interruptions may be "acts of God" such as earthquakes, wind storms, or ice storms or may be caused by accidents or planned outages by Utility repair crews doing maintenance or upgrades on power systems. The novelty of the present invention is to transform the traditional generation station (large or small) into an energy integrating hub where the energy created by the fossil fuel generating device (a turbine or reciprocating engine-generator for examples) is seamlessly blended with the energy created by renewable energy sources or transferred from energy storage devices to be A.) additive power for the fossil generator, B.) combined power with the fossil generator to reduce the overall systems consumption rate of fossil fuel, or C.) fully substitute for the fossil fuel consumption needs of the system when the renewable sources or stored energy sources are sufficient to meet the load requirements placed on the system.

[0020] In fairly common circumstances fossil fuel generation sources of power are the primary source of electrical or thermal energy in numerous parts of the World. In many island nations and frequently in Third World locales, fossil fueled generators are used as prime power for a majority of the power needs on the island or the neighborhood. While it is becoming common for users of such power to add their own solar, wind generators, and back-up battery systems these are examples of "distributed generation" and not a modification to the centralized power plant as proposed here.

[0021] A first novelty of this invention is that millions of home-standby generator systems which may only function for a week or two every 6 years when a hurricane disables power service can become daily sources of power through the integration of home-installed renewable energy sources. Depending upon their design and sizing these renewable energy generation and storage devices may be fully capable of meeting the individual residence's daily power needs without running the included fossil generator device or without importing any grid supplied electricity.

[0022] A second novelty of this invention is that a plurality of these systems operating in neighborhood microgrids can readily relieve summertime stress on overtaxed Utility systems and help prevent brown-outs or rolling blackouts. As more and more coal fired power plants are sunsetted and in Nations where policy decisions dictate a planned retirement of nuclear power plants a network of such power systems can meet growing demands for sustainable energy sources. In one possible scenario, where Utility Companies promote and install such generation devices the control systems described in this system can allow Utilities to remotely dispatch large networks of these systems to avoid an unplanned but predicted power emergency situations.

[0023] A third novelty of this invention is that as smart-grid systems with their "time-of-day" pricing algorithms diffuse across a National scale the software-defined control system embedded in this system will activate the energy storage device designed into this system so it can be charged with relatively low-cost off-peak power sources and then return stored energy during peak-price times and essentially eliminate peak-demand over load pricing for the home or business owner. While this is an obvious advantage to the user customer it is also a substantial help (assuming large scale use of these systems) in balancing regional loading for multi-State Transmission and Distribution systems (so called "systems operators").

[0024] A fourth novelty of this invention is that its widespread use will contribute to National Energy Security because it is an elegant answer to growing concerns about cyber-attacks on an increasingly software-controlled energy generation and distribution systems or intentional damage to central power plants, oil or natural gas pipelines, and major trunks in the Nation's electrical T & D systems (the Grid).

[0025] A final novelty of this invention is its ability to reduce fuel consumption and personnel casualties in refueling operations for the military. It is estimated that in-theatre costs of refueling are in excess of $400 per gallon of fuel and adding the hostile engagements with fuel supply